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AUTHOR Resta, Paul
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ABSTRACT

Project CIRCLE, a project conducted by the University of Texas Learning Technology Center in collaboration with the Austin Independent School District and the Eanes Independent School District, explored the use of network-based tools to help change teacher practices toward more student-directed and constructivist approaches to learning. Through the use of groupware, the project developed collaborative knowledge-building communities within two high schools. The project demonstrated the efficacy of the tools to help foster collaboration within and between classrooms and the use of high school students as technology mentors for teachers. Topics discussed include: (1) project focus and specific goals--to establish a collaborative knowledge-building community of teachers and students in the school, to develop the CIRCLE model training program, and to develop a self-sustaining program of training and technology infusion in the schools; (2) the approach and tools for collaborative learning--FirstClass, Daedalus, and TeamFocus; (3) project evaluation methods, including both quantitative and qualitative components; and (4) findings related to the Project CIRCLE Training Model, developing collaborative learning communities, developing a self-sustaining program, teacher utilization and perceptions of student mentors, the role of student mentors, and effects of the CIRCLE Learning Model on students' learning, performance, behavior, and attitudes.
 (Author/DLS)

Collaborative Technologies as a Catalyst for Changing Teacher Practices

Dr. Paul Resta

Learning Technology Center, The University of Texas at Austin, Austin, Texas 78712, USA
Tel: 512-471-4014, Fax: 512-471-4655, E-mail: resta@mail.utexas.edu

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Abstract: Project Circle explored the use of network-based tools to help change teacher practices toward more student-directed and constructivist approaches to learning. Through the use of groupware the project developed collaborative knowledge-building communities within two U.S. high schools. The project demonstrated the efficacy of the tools to help foster collaboration within and between classrooms and the use of high school students as technology mentors for teachers.

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1. Introduction

Project CIRCLE, a two year project funded by the U.S. Department of Education, explored the use of collaborative technologies as a catalyst for changing teaching practices and development of knowledge-building communities within U. S. high schools. The study involved secondary teachers and students in two high schools, one is a low-income, inner-city high school, and the second, a high income suburban high school. The project was conducted by the University of Texas Learning Technology Center in collaboration with the Austin Independent School District (AISD), and the Eanes Independent School District (EISD). The study explored the use of *Daedalus*, *FirstClass*, and *TeamFocus* as tools to support collaborative learning projects in the partner schools. The project was designed to foster collaboration both within and between classrooms and schools. A virtual learning community between the project schools and university was created using network-based tools for collaborative learning and intellectual work. Through new collaborative technologies students and teachers accessed community-based curriculum materials, on-line mentoring and collaborative learning projects between university and high school students.

The project provided key teachers and administrators basic training and experience using networked software. They worked individually and collaboratively in designing and applying the tools within their content area courses or in collaborative interdisciplinary projects.

The project also involved the training and apprenticing of selected students at each site to serve as "in-house" mentors and technology assistants for their teachers and fellow students. The first-year cadre of teachers and student-mentors at each site served as the core group to assist and mentor teachers in the second year of the project and to help induct more teachers and student-mentors into project activities.

2. Project Focus and Goals

The project was based on a constructivist approach to the learning process. The constructivist model of knowledge emphasizes the active engagement of the learner to construct meanings in all levels of apprehending, comprehending, and processing the information. It also recognizes the importance of the social context as a required catalyst in the learning process.

The constructivist model of learning holds that new knowledge must be built through the socially dynamic and interpersonal interplay of experiences, beliefs, and prior knowledge each individual possesses and shares within a community of collaborative learners. In this model, knowledge is the result of work of the individual to make meaning out of information and to expand individually-held knowledge through the interaction of other learners in the social context of a learning community. The social component of knowledge-building is the catalyst in the process: as an individual makes sense of new information or experience, she or he expresses it to others who actively enter into the knowledge-building dialogue to confirm, modify, question, contradict, or correct shared information. In this collaborative knowledge-building process, all participants are acting independently and collaboratively to make personal and community meaning of new information as different partners find, question, create, share, correct, and argue ideas, concepts and principles.

Based on this orientation, the specific goals of the project were to:

1. *establish a collaborative knowledge-building community of teachers and students in the schools* to explore and model innovative constructivist uses of technology in the classroom. To accomplish this objective interactive networks were established and new telecommunication approaches were used to connect school and university members of the knowledge-building community to each other as well as to other mentors or experts locally, nationally, and internationally.
2. *develop the CIRCLE model training program.* Training programs were developed to introduce and develop initial levels of competency in use of the specific collaborative learning tools. It involved one day training sessions held in the university computer labs as well as on-site training. Training was also provided to students selected to serve as technology mentors to the teachers and fellow students. They received separately the same training in the application of the tools as the teachers.
3. *develop a self-sustaining program of training and technology infusion in the schools.* The study explored ways of sustaining and widening the circle of participating teachers and students in the use and integration of the collaborative technologies. It also explored the impact of the project on the teacher cultures within the schools.

3. Approach and Tools for Collaborative Learning

Project CIRCLE provided computers, modems, and phone lines to the participating schools. The project staff helped the schools configure the computers and, in some instances, helped in networking the computers. During the first year three intensive full-day training sessions were provided at the university for teachers to gain a basic level of understanding and competency in using each of the three collaborative groupware tools. In addition, on-site, one-on-one, and small group training was provided by University project staff. The student mentors received the same training as the teachers. During the week following the training, student mentors helped set up applications for use in class. During the second year, the first year cadre of teachers assumed the leadership role as trainer-mentors for the new participating teachers. All training was provided on-site and no full-day university training sessions were held.

Three major tools were used to support collaborative knowledge-building.

3.1 FirstClass

FirstClass provides an integrated cross-platform collaboration environment with powerful, flexible and intuitive features that supported all members of the knowledge-building community. It tied together participating high school teachers, students, university faculty and students and on-

line mentors using state-of-the-art groupware for both LAN and Internet connections. Students and teachers were able to create and maintain their own individualized resumes and conferencing areas. For example, teachers had their own private conferencing area, *The Circle Bar and Grill*, to share problems and ideas. Teachers and students were able to collaborate with professionals through Internet newsgroups, and socialize through on-line chats. Class discussion conferences were created to support classroom learning projects both within and between the two high schools.

3.2 Daedalus

Daedalus is an integrated cross-platform suite of six programs that encompasses all stages of the writing process, from brainstorming and prewriting to drafting and revising to final production. *Daedalus* has been developed through years of research and field-testing by English scholars.

The programs include:

- The *Write* program is a simplified word processor which serves all other *Daedalus* programs. It is suitable for writing papers and is offered as freeware to the students in order to make their work on the system portable.
- The *Invent* program presents the student with heuristic prompts, or questions, to guide their writing.
- *Respond* guides critical reading by asking critiquing questions of a displayed text. Teachers may customize the prompts to fit their own purposes in both *Invent* and *Respond*.
- *Mail* is an E-Mail program specifically designed for use within a class or between many classes.
- *InterChange* is a real-time conferencing program in which an entire class can simultaneously write to a single document. Each student has his/her remark labeled with his/her name, and may reply to specific remarks that appear in the dialogue.

3.2 TeamFocus

TeamFocus is a network-based environment to support collaborative problem-solving, brainstorming, analysis, prioritizing and decision-making. The tool has been used primarily in industry and it was introduced to explore its values in the science, social science and business curriculum.

4. Project Evaluation Methods

Project evaluation was conducted by an external research team comprised of a university professor and five graduate students from the Department of Education Psychology. The team developed an evaluation model that included both quantitative and qualitative components. Qualitative data included classroom observations, and in-depth teacher and student interviews. Quantitative data included statistical analysis of student responses on the *Student Perception of Collaborative Knowledge-Building* (SPOCK), an instrument designed and validated for the study, and student test scores on state standardized tests of academic skills.

5. Summary of Findings

5.1 The Project CIRCLE Training Model

The results of interviews suggests that university training and on-site training and support were positively received by the teachers. The first year training and support was highly successful but there were problems with the first year teachers serving as trainers and mentors for the teachers joining the project during the second year. A number of the second year teachers expressed their

concern about the limited level of technology knowledge and skill they were able to develop through the peer mentors. The interviews and observations also indicated that the second year teachers were less successful than the first year teachers in implementing the technology applications within their classrooms. These trends suggest that the use of co-teachers as trainers and mentors related to innovative new technology tools may require more time and support to be successful. Mentoring and collaboration among the teachers and the use of student mentors as a support system, although useful, was not sufficient to help teachers develop levels of comfort and competency in the use of new technological tools. The general response of teachers indicated the need for more intensive training sessions, similar to those provided in Year 1 of the project.

5.2 Developing Collaborative Learning Communities

Over the two years of the grant, Project CIRCLE demonstrated that, with sufficient time, training and on-site support, teachers could infuse collaborative technologies into their classroom instruction. In addition, the application of the collaborative technologies may begin to transform the teaching-learning process, moving it toward a more collaborative, student-directed learning environment. The shared training, on-line communications, and tools for collaboration also helped foster the development of a knowledge-building community. An important attribute of this community was the honoring of the unique expertise and contributions of each member as well as the recognition that we were all co-learners together.....students, teachers, and university faculty.

Marked differences were observed between first year and second year project teachers in establishing collaborative communities within their classrooms. This suggests that teachers must have time, training, and support to enable them to embrace and adopt new technologies and teaching practices. As teachers became more experienced, they were able to develop higher levels of competency and comfort with the collaborative tools and explore changes in their classroom instruction. Teachers who had less time and support were less effective in integrating the tools into their instruction and experienced more problems in implementation.

Another critical factor in successful development of collaborative learning communities was the limited access to technology experienced by a number of teachers who were interested in participating in the project.

Results of the study indicated that teachers who used the new collaborative technologies to "do things differently" in their classrooms tended to be the most successful. The least successful were teachers who attempted to fit the collaborative technologies into their traditional teacher-directed approach.

In brief, the project results indicate that success in the adoption of the new collaborative technologies requires extensive training and support and easy access to the technology.

5.3 Develop a Self-Sustaining Program

The CIRCLE project explored factors related to the sustainability of the model of training and technology infusion. Sustainability requires both long term support from the school administration and the retention of an active, committed, and respected core cadre of teachers to continue to engage, interest, and support other teachers in the use of the new technological tools. This was evident from the loss of the two inner city high school teachers who were regarded as the project innovators and leaders. Their departure, coupled with a change in the school administration, greatly diminished the momentum and progress achieved in that school during the two years of the project.

Perhaps the greatest barrier to sustainability is teacher time. Teachers are continually overloaded with their regular duties. It was difficult for the teacher-mentors to have the time and flexibility to help provide one-on-one training or classroom assistance to teachers when needed because of their other duties and time constraints. It was also difficult for interested teachers to find time to be mentored or to explore the use of the new collaborative technologies. All these issues must be addressed in order to sustain and expand the implementation of the new collaborative technologies.

5.4 Teacher Utilization and Perceptions of Student Mentors

A key aspect of the CIRCLE model training program was the use of student mentors [students trained in the software] to provide on-going training and support to teachers and other students. Student mentors helped teachers learn the programs and served as in-classroom technical support staff. For example, student mentors would set up Daedalus interchanges, establish and maintain conference areas on the FirstClass system and assist teachers in other technical applications. Teachers felt that the student mentor component of the program was both useful and innovative. They indicated that, unlike themselves, students showed no anxiety about attempting new and challenging technology applications. They would set up the software programs for the teacher, and consequently, the teacher would begin to use them. Over time, the teachers developed deeper levels of understanding and comfort in the use of the collaborative technology.

5.5 Role of Student Mentors

Teachers noted that the student mentors were a valuable and effective technology resource and support system and was superior to more traditional types of teacher training and support. The student mentors were unanimous in their view that the role of student-mentor was rewarding and an effective means of providing technology training and support within their schools. A number of high-risk students serving as mentors indicated that their relationships and status changed positively both with their classroom teachers and their peers because of their role and expertise as a student mentor. When asked what was good about the model, the student mentors indicated that it was more personal than a class and that it helped ease teacher's anxieties about using computers. They also noted that "teaching the teachers" reinforced their own feelings of worth and contribution to the school. Similar to the teachers, the student mentors indicated that it would be helpful to have more time and flexibility to assist teachers when needed. To partially address this need, the inner city high school established a student mentor class that provided in-depth technology training and allowed the students to assist teachers during the class period.

Teachers indicated that another important benefit of the student mentor program was the improved behavior, attitudes, and engagement of the student mentors who had previously been disengaged from the learning process. Teachers in the inner city school noted that all of the student mentors now expressed aspirations for pursuing post-secondary education.

5.6 Effects of the CIRCLE Learning Model on Students' Learning, Performance, Behavior, and Attitudes

The results of the quantitative analyses, using the student perceptions survey, suggests that the intergration of collabrative technologies facilitates students' knowledge building and intentional learning in the classroom. Students in classrooms where CIRCLE software was implemented perceived increased cooperation, question asking, and knowledge building activities. These quantitative findings were supported by teacher comments indicating higher levels of cooperation between students and between themselves and students when they used CIRCLE software. These findings suggest that the CIRCLE learning model was successful in its goal of creating a collaborative, knowledge building community in the classroom. In addition, the study results indicated that, in the inner city high school, students in classes integrating the collaborative technologies had higher standardized test achievement scores than a control group within the same school.

The results also indicate a positive effect on students attitudes and motivation. Teacher responses suggest that implementation of the CIRCLE software improves student motivation, engagement, and attitudes toward learning, particularly among students who are not currently successful or highly motivated in the traditional classroom. Some students who are very successful in traditional teacher-directed classroom settings, however, are not as comfortable with the collaborative learning environment.

6. Conclusions

Results of the two year project indicate that the introduction of new network-based environments and tools for collaborative learning can be an effective means for helping teachers develop more collaborative, student-directed learning environments. The infusion of collaborative technologies, however, must be accompanied by extensive training, on-site support, easy access to the technology, and strong support from the school administration.

Sustainability of the innovative practices is dependent on the retention of a core cadre of teacher-leaders who continue to model and extend the circle of participants. In addition, the findings indicate that the use of teachers as mentors to their fellow teachers may not be effective unless the mentor teachers are provided with adequate release time to take on the added responsibilities and be available to respond to fellow teacher's needs.

The project results suggest that student mentors can serve as an effective technical support system for teachers who are implementing the new technology tools and applications. The role of student mentor may also produce benefits to the students including improved motivation, status, attitudes and post-secondary aspirations. In addition, it appears that "at-risk" students selected as teacher mentors may demonstrate greatly improved relationships with the teachers and increased interest in school and academic work.

Lastly, the study indicates that the creation of collaborative knowledge-building communities within the classroom results in an increase in student engagement, motivation and improved performance on standardized tests of academic skills by inner city high school students.

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